

Innovación y Gestión del Conocimiento

Determinant Factors of the Organizational Innovative Performance: Cooperation, Absorptive Capacity and Public Policy

Abstract

This paper aims to analyze the determinants of the innovative performance of the Portuguese firms which, in the context of this research are: cooperation, public policies to stimulate innovation and absorptive capacity. Indeed, the set of approaches that have come to appear as a reference of the subject of innovation are assumed of conceptual importance, leading to an empirical basis that allows to analyze the determinants of innovative performance, using the available data from the Community Innovation Survey CIS 2010 and the application of statistical patterns, through logistic regression models.

Keywords: Innovation, Cooperation, Public Policy, Absorptive Capacity and Innovative Performance.

1. Introduction

Conducting research on the subject of innovation is assumed to be a challenge that has experienced an important evolution and adaptation of the concept to other sectors and areas of society and the economy. This has greatly contributed to raising firms' level of knowledge (both domestic and foreign) and to the performance and innovative dynamics of territories by encouraging a way of action that gives prominence to the participation in cooperation networks founded on inter-organizational relationships rather than on isolated interventions (Koschatzky, 2002; OECD, 2005; Chesbrough *et al.*, 2006; Witzeman *et al.*, 2006; Johnson, 2008; Rasera and Balbinot, 2010). In the scope of this investigation, it is understood that innovative performance is also both a trigger and a generator of a competitive advantage (Falk, 2012), which is crucial for firms to be able to develop in a sustainable manner over time (Ramos and Zilber, 2015). Innovation is thus regarded as a constant challenge for firms and a core of opportunities. Hence, to take on the commitment and challenge of constant self-innovation, firms must adopt a strategic approach aimed at making investments to enhance their ability to create new knowledge (Ramos and Zilber, 2015) and disseminate new information. This corporate action requires, therefore, qualified preparation, efficient adjustment to the conditions of the business context and a quick, preceding and distinctive response to the growing needs of customers in competitive markets. According to Earl and Gauld (2006), the evolution of the concept of innovation, in line with the approaches of Schumpeter, arises with the development of new markets, new achievements in existing markets or changes that produce new organizational structures and business practices regarding the transaction of goods and services. The same author is considered by the OECD as a pioneer in highlighting the innovative purposes of the public sector (OECD, 2005). Indeed, the concept of innovation has evolved into an approach that extends far beyond the borders of material technology and R&D but is not restricted to these two dimensions (author, 2003). Thus, from the 1980s onwards, authors have made important contributions about innovation from a systemic perspective by conveying relevance to certain external factors that influence and determine the innovation process (Lundvall, 1985; Freeman, 1987; Dosi *et al.*, 1988). For the purpose of this research, the concept of **organizational innovation** is also registered, which refers to "the introduction of a new

organizational method in business practices (including knowledge management), organization of the workplace or external relations of the firm” (OECD, 2005; GPEARI-MCTES, 2010; DGEEC-MEC, 2012). According to Monteiro-Barata (2005:301), in Portugal, whose economy is a small and open one with a fragile scientific and technological system, despite enjoying considerable improvements of late the experience of supporting innovation processes is a fairly recent one.

2. Literature Review

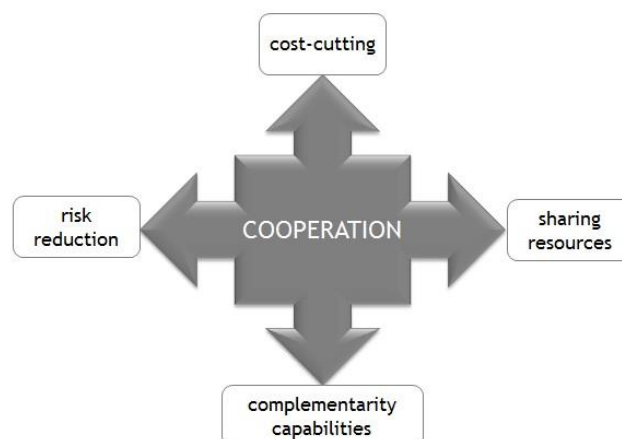
The research that follows aims to contribute to the analysis of innovative performance **in terms of organizational innovations in Portuguese firms**, of which the considered determinants – cooperation, absorptive capacity and public policy – influence and reflect the country’s economic scenario.

2.1. Cooperation

Innovation for cooperation has become an increasingly prominent feature of firms’ innovation activity. The recognition of cooperation within innovation processes has been increasingly prominent (Hagedoorn *et al.*, 2000; Carvalho, 2003; Narula, 2004; Lenz-Cesar and Heshmati, 2012), becoming a subject that, according to Miles and Snow (1986), achieved special recognition from the 1980s onwards, when the adequacy of business activity to meet the requirements in the field of competitiveness, characteristic of performance on the global scale, was perceived as necessary. Authors such as Cohen and Levinthal (1990) and Cassiman and Veugelers (2002) justified the assertion that cooperation for innovation should ensure that there is an absorptive capacity leading to the advantages of firms in acquiring more knowledge, often a result of *spillover* effects, hence increasing their profitability and the positive returns achieved through cooperation, mainly concerning R&D activities. This perspective was reinforced by Mark and Graversen (2004), who understood well that cooperation also helps to increase firms’ ability to benefit from participating in future R&D projects on a cooperative basis. Also, Carvalho (1997:8) refers that “cooperation strategies are a response of firms to the challenges created by the globalization of markets and the consequent intensification of competition and to the challenges arising from a turbulent environment marked by a permanent change, but also to the emerging challenges of increasing complexity and inter-sectoral nature of the new technologies that require firms’ expertise in several technological areas”.

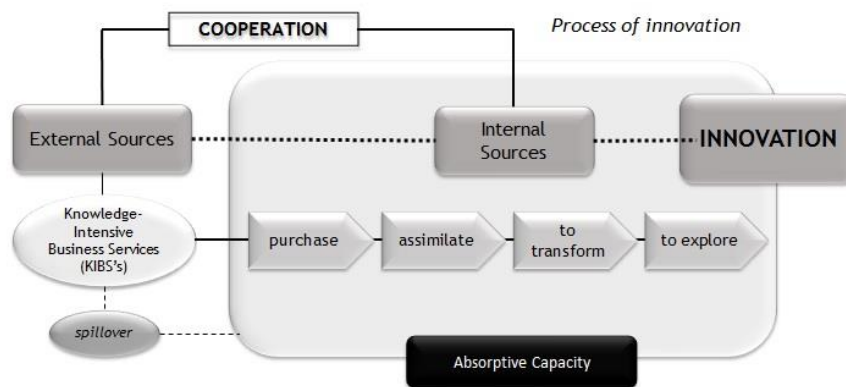
Figure 1 provides a synthetic representation of the advantages of cooperation within the framework of corporate innovation processes in accordance with the main perspectives analysed.

Figure 1 – The advantages of cooperation



According to Paananen (2009), the sources of information and cooperation are the key elements of contemporary innovative initiatives, before which the demand for a combination of constant sources can also be regarded as a process by which dispersed knowledge becomes part of an innovation process. Also, Reis, Tolda and Coelho (1999) mention the breadth of the knowledge base of a firm that is not defined only by its intramural operation. The external relations in which the firm operates, providing access to knowledge that can be endogenize, promoting complementarities among the various actors involved in these knowledge transfer processes. In **Figure 2** the process of innovation is outlined according to the sources of information and cooperation.

Figure 2 – The sources of information and cooperation an innovation process



Source: Self elaboration.

It is concluded so “cooperation is an important strategic tool to maintain and strengthen the competitiveness of firms through a joint effort, to allow the exploitation of synergies”, Carvalho (1997:9).

2.2. Absorptive Capacity

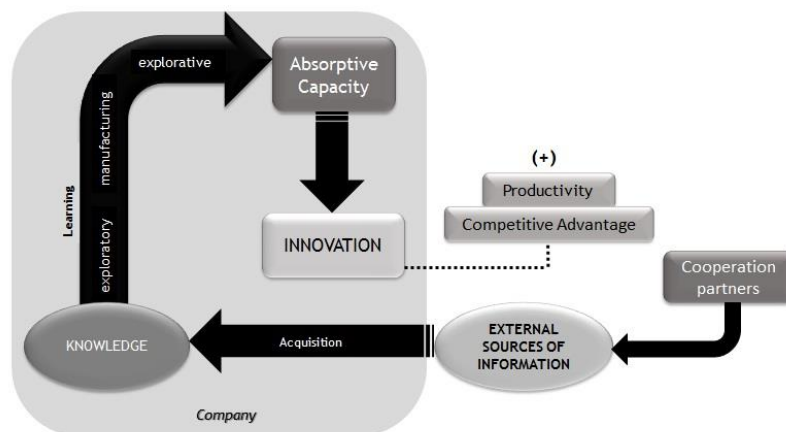
Absorptive capacity, as a concept, was first introduced by Rostow, referring to firms’ ability to influence the economic growth of a region by virtue of the capacity to adapt to political, social and institutional change, thus increasing the level of absorption of innovation (Rostow, 1956, 1980; Lau and Lo, 2014). The concept has gained increasingly important recognition, therefore assuming the role of the prime encourager of firms’ competitive advantage (Lichtenthaler, 2009).

According to Berger (1982: 133), “the concept of absorption capacity has become part of the economic terminology in the 50s, the decade in which many politicians and economic experts shifted their interest away from the post-war process and the reconstruction regarding the economic problems of the underdeveloped countries of the Third World”. Focusing on the concept analysis taking into account the corporate action field, authors such as Teece *et al.* (1997) have reported that the external knowledge from which firms can benefit, as

well as their ability to assimilate and integrate it into their internal knowledge, determines firms' ability to use and develop resources with added value.

In the context of the contemporary performance of the markets, in which the business environment is knowledge-intensive, firms are necessarily more dependent on external sources of information to expand their innovative performance (Cassiman and Veugelers, 2002; Morgan and Berthon, 2008, Catozzella, and Vivarelli, 2014), which is only likely to be achieved if firms ensure this ability to acquire, assimilate, transform and apply knowledge with a noticeable impact on their results. It is therefore recognized that, in the current context, in which firms operate in a business environment on a global and intensive scale as far as knowledge is concerned, it is imperative for firms to resort to and use all the knowledge gathered externally, to promote innovation and, consequently, to raise their innovative performance (Lane, Salk and Lyles, 2001; Abecassis Coins and Mahmoud Jouini, 2008), increasing their productivity and asserting themselves on the scale of competitive advantage. **Figure 3** reports the process related to the absorptive capacity in firms considering the theoretical contributions on this topic.

Figure 3 – The absorptive capacity in firms

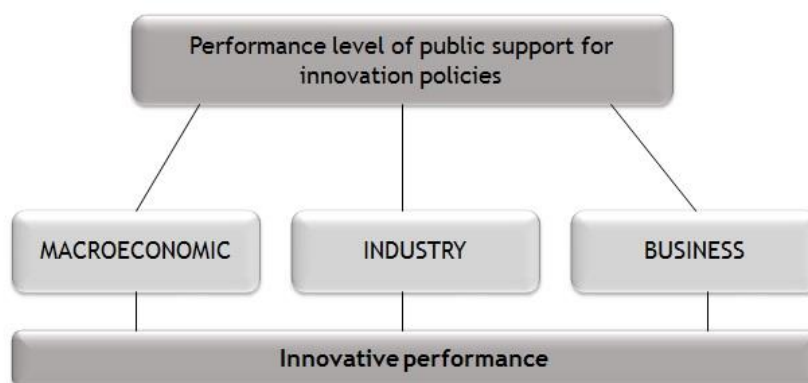


Source: Self elaboration.

2.3. Public Policy

Innovation policies formally emerged during the 1980s, in response to economic stagnation, using the enhanced competitiveness of firms (Santos, 2003) in the context of globalization that required of firms, organizations and regions a more assertive performance, which exceeded mere technological innovation and widened the innovation range to other areas, giving way to the emergence of an innovation environment promoted by social change. New ways of governance were introduced in most developed countries to improve efficiency due to the implementation of innovation incentive policies (Hartley *et al.*, 2013). The impact of innovation policies on economic performance is higher in internationalized regions (Bannò, Morandi and Varum 2013). Porter and Stern (2001) stated that public policies related to innovative performance are the foundation of any process, given that they comprise instruments and procedures that may be formalized on three performance levels (Stern, 2001; Moreira, 2010), as schematized in **Figure 4**:

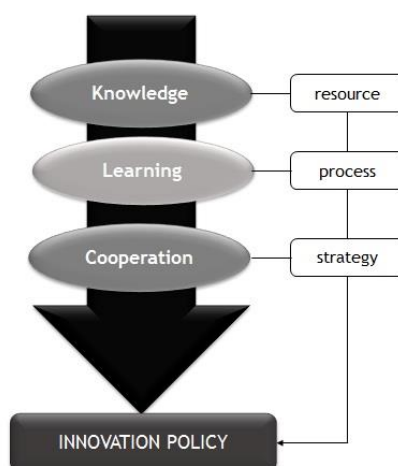
Figure 4 – Performance levels of public support for innovation policies



Source: Self elaboration.

Authors like Mani (2004) and Hyttinen Toivanen (2005) have professed that public financial support provides all the necessary resources to improve the performance of firms in terms of innovation, with consequences for the economic performance of national innovation systems. Innovation policies are also, according to Aranguren and Larrea (2011), designed primarily following a top-down approach, according to which policymakers select incentive measures that will be channelled mainly to firms and other regional agents. This leads to disparities in the innovative performance at the local and regional levels, requiring the adaptation of these measures and policy instruments, which must be created and implemented in line with the context and the cooperation networks that already exist. About the most recent forms of entrepreneurial interaction bases for innovation, Noronha Vaz, Cesário and Fernandes (2003), argue that such forms must be considered in the preparation of policies to support the development of less favoured regions, stressing the importance of decentralisation of decision and learning in that process. This matter of public policy hence refers to interactivity in its construction and implementation that requires acting in cooperation with its beneficiaries, thus acknowledging the relevance of training, learning and shared knowledge among those who implement policies and those who benefit from them, essentially firms (Aranguren and Larrea, 2011). These can easily be identified in previous research contributions, as in the case of Lundvall (1992), who stated that knowledge is the most important feature, learning is the key process and cooperation is the most prominent strategy for innovation, as described in **Figure 5**.

Figure 5 - Scheme of innovation policies

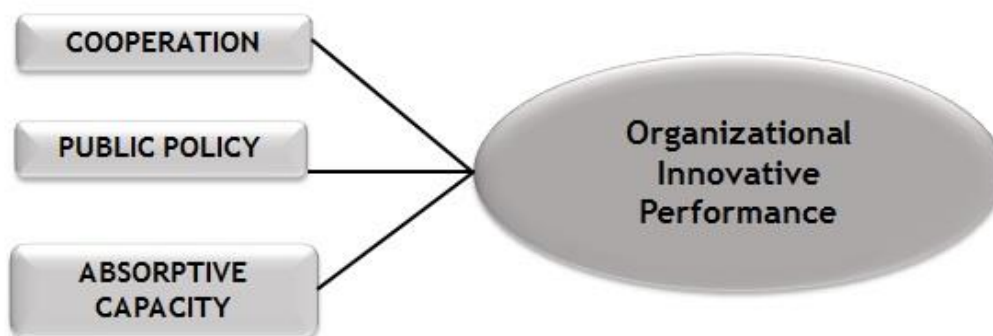


Authors like Evans (1995), Rodrik (2004) and Avnimelech and Teubal (2008), however, have advocated the importance of the emergence of new guidelines regarding public policy, leading to a paradigm shift, which may result in key proactive measures for the development of R&D activities that will enhance the innovative performance and exceed the mere protection and selection of tax incentives or government measures. Specifically, about Portugal, Carvalho (2006:211) argues that “Portugal has structural problems concerning the investment in R&D activities, in particular business R&D, which weaken the innovative activity of the Portuguese business sector and its competitiveness in an international context, and hinder the transition to a knowledge-based economy”. Just, the absence of enabling conditions in Portugal, such as those referred by Carvalho (2006:211), as: “the low qualification of human resources; the fact that corporate culture still poorly suited to invest in R&D; a business structure with many small firms and the low importance of high-tech industries; the weak interaction between firms and research institutions, and a poorly rooted innovation culture” affects the innovative performance of Portuguese firms.

2.4. Conceptual Model and research hypotheses

The objective of the present paper is to contribute to the analysis of innovation, particularly concerning the **innovative performance of firms associated with organizational-type innovations**, as displayed in **Figure 6**.

Figure 6 – Research conceptual model



Source: Self elaboration.

The research hypotheses that will be presented, in addition to having a theoretical foundation that supports, according to previously presented literature review, will be empirically tested and analyzed. Precisely, this analysis aims to understand the potential influence of model determinants, admitting that they influence the innovation processes of firms and hence their innovative performance.

First and foremost, all the data obtained were gathered from the CIS 2010, which collects official statistical information from the Community Innovation Survey. Therefore, the following research hypotheses were considered (**Table 1**):

Table 1 - Hypotheses Research according to the determinants of analysis

Determinants	Hypotheses	Variable response
Cooperation	<i>H1.1: Sources of information and cooperation with domestic partners are positively related to firm's propensity to innovate.</i>	Organizational Innovative Performance
	<i>H1.2: Sources of information and cooperation with market partners are positively related to firm's propensity to innovate.</i>	
	<i>H1.3: Sources of information and cooperation with institutional partners are positively related to firm's propensity to innovate.</i>	
	<i>H1.4: Sources of information and cooperation with other partners are positively related to firm's propensity to innovate.</i>	
Public Policy	<i>H2.1: The implementation of innovation fostering public policies regarding financial support from community funds is positively related to firm's propensity to innovate.</i>	
	<i>H2.2: The implementation of innovation fostering public policies regarding central or national financial support is positively related to firm's propensity to innovate.</i>	
	<i>H2.3: The implementation of innovation fostering public policies regarding local or regional financial support is positively related to firm's propensity to innovate.</i>	
Absorptive Capacity	<i>H3.1: The qualification of human resources is positively related to firm's propensity to innovate.</i>	
	<i>H3.2: An increase in the proportion of internal investment in R&D is positively related to firm's propensity to innovate.</i>	
	<i>H3.3: An increase in the proportion of external investment in R&D is positively related to firm's propensity to innovate.</i>	

3. Data, method and variables

3.1. Data

The data used in this research are secondary data, collected through a survey that consisted of a questionnaire named Community Innovation Survey – CIS 2010 between July 2011 and April 2012. In Portugal, the survey was conducted by GPEARI – Gabinete de Planeamento, Estratégia, Avaliação e Relações Internacionais (Department of Planning, Strategy, Evaluation and International Relations) in collaboration with INE – Instituto Nacional de Estatística (National Institute of Statistics), according to EUROSTAT'S methodological specifications, and concerning innovative activities of Portuguese firms.

3.2. Method

In the present investigation we intend to study innovative performance as a process influenced by a set of factors. Faced with such a scenario, it is therefore considered data that allow characterize firms and territories, more specifically data to obtain results associated with the innovative performance of firms on the national scene. It is therefore of a quantitative method for data collection, leading to an empirical basis that allows to analyze the

determinants of innovative performance, using the available data from the CIS 2010 and the application of statistical patterns, through logistic regression models.

3.3. Variables

3.3.1. The variables associated with Cooperation

To this determinant one may add three variables, presented as a scale chart comprising the following results, in accordance with the degree of importance: irrelevant/not used = 0; low = 1; medium = 2; and high = 3. For internal sources the variable takes the value “0” if it is considered to be irrelevant and “1” if it is considered to be highly relevant. There are three types of cooperative relationships with relevant external partners, according to the respective sources of information (market sources, institutional sources and other sources), as well as internal sources.

3.3.2. The variables associated with Public Policy

The information on this category allows, in addition to the clarification of the level of influence of public policies on the innovation processes of firms, the clarification of the origin of this support, characterizing it as follows: public policies for financial support at the **local/regional administration** level, public policies for financial support at the **national/central administration** level and public policies for financial support from **the European Union (EU)**. To this determinant analysis three dichotomous variables were added, assuming the value of “1” when a firm confirmed that it received public financial support according to the three types of public financial support and the value “0” if there was no access to public financial support.

3.3.3. The variables associated with the absorptive capacity

This category of research is determined by the technological effort of the firm to develop some of the following innovation activities: R&D activities within the firm (intramural); external acquisition of R&D (extramural); and the approximate percentage of employees with higher education. It is, therefore, a constructed variable that combines the investment in innovation activities with the level of staff with higher education. Acknowledging the diversity of empirical investigations that have focused on the analysis of the absorptive capacity, without, however, the existence of a general concurrence to guide the analysis to concrete variables (Escribano *et al.*, 2009), the researchers chose to adapt this research to the literature review and data obtainable from the CIS 2010 (GPEARI-MCTES, 2010). Therefore, it was decided to transform the variable ratio into a categorical variable format, considering seven levels/ranks, as executed in the CIS 2010 when approaching the estimated percentage of employees.

4. Results

Table 2 displays the results of the application of the regression logistic model for the innovations of organizational type.

Table 2 - Determinants of innovative performance in terms of organizational innovation

<i>Independent variables</i>	Inicial model				Final model			
	B	S.E.	Sig.	Exp(B)	B	S.E.	Sig.	Exp(B)
Cooperation								
Internal sources of information and cooperation	0,232	0,083	0,005	1,262	0,245	0,082	0,003	1,278
Sources of information and market cooperation	0,165	0,142	0,246	1,179				
Institutional sources of information and cooperation	0,023	0,080	0,775	1,023				
Other sources of information and cooperation	0,432	0,092	0,000	1,540	0,518	0,056	0,000	1,678
Public Policy								
European Union	0,306	0,152	0,045	1,358	0,345	0,148	0,020	1,412
Central Administration	0,076	0,098	0,433	1,079				
Local Government and Regional	0,242	0,249	0,331	1,274				
Absorptive capacity								
Employed persons with higher education	0,156	0,025	0,000	1,168	0,156	0,024	0,000	1,169
Intramural R&D activities	0,040	0,015	0,006	1,041	0,043	0,014	0,003	1,044
Extramural R&D activities	0,095	0,018	0,000	1,100	0,097	0,018	0,000	1,102
Constant	-0,796	0,100	0,000	0,451	-0,731	0,085	0,000	0,482
Model fit quality								
Correctly predicted (%)	66,60%				67,10%			
Qui square	330,408	0,000			327,0	0,000		
Log likelihood	4120,49				4123,9			
Number of cases	3 406				3 406			

The results of the final model present all the estimates of statistically significant regression parameters at the 5% level, the Wald statistic having been used as a test statistic. Regarding the adjustment quality of the final model, the results show that the model's predictive value is 67.1%, resulting from the comparison between the response variable values predicted by the model and the observed values.

The statistics of the Qui-square test have a value of 327.0 with a probative value lower than the 0.05 significance level. The log-likelihood statistics, with a value of 4123,901, support the global significance of the model compared with the null model.

Regarding cooperation, the final model of logistical regression allows only the confirmation of hypotheses **H_{1.1}** and **H_{1.4}**. Given these results, the first hypothesis links the propensity to innovate with the cooperation with *internal sources of information and cooperation*. Thus, it is clear that there is a positive and significant effect on the propensity to innovate at the organizational level, which is proven by the estimate of the associated parameter (0.518) as well as by the analysis of the advantage associated with the variable (1.678). Therefore, as a firm's cooperation with internal partners increases, so does its propensity to innovate organizationally, with an advantage of 1.678 in comparison with firms that neither cooperate nor consider internal sources in the innovation processes.

In addition to the contribution of several authors acknowledging the importance of internal information sources, the results obtained set some boundaries concerning the relevance that is also advocated by many regarding the combination of internal sources with external sources (Lazzarotti and Manzini, 2009). Nonaka and Takeuchi (2003) were strong defenders of the notion that an efficient flow of information, combining internal and external sources, has the “supra-effect” of raising firms’ ability to acquire and assimilate knowledge that confers a beneficial and competitive position.

The second confirmed hypothesis is related to other sources of information and cooperation, with a value of the point estimate of the associated parameter (0.245) and a value of the benefit ratio associated with the variable (1.278) that lead one to conclude that there is a significant and positive relation with the propensity to innovate. Consequently, as the cooperation with other business partners increases, so does the propensity for a firm to innovate at the organizational level, with an advantage of 1.278 when compared with firms that choose not to cooperate with other partners. Such results are corroborated by authors like Cassiman and Veugelers (2002), Hagedoorn (2002), López (2008) and De Faria *et al.* (2010), who stated that cooperation, regardless of the partners involved, provides firms with the opportunity and the benefit of access to resources that are complementary and that directly enable the more efficient development of innovative activity. About the other sources of information and cooperation, according to Monteiro-Barata (2005:306), in “terms of external sources in R&D activities, for example, preferences from the firm range from technology centers to universities, while one should stress a new external source of R&D activity within the value chain: clients”.

As evidenced by the results shown in **Table 1**, at the level of cooperation, the variables *sources of market information and cooperation* and *sources of institutional information and cooperation* do not have statistical significance; hypotheses **H_{1.2}** and **H_{1.3}** are, therefore, not confirmed.

As regards public policy, the results obtained in the final model of logistic regression only provide information about the public financial support from the European Union, from which one may assume the existence of a positive and significant relationship of this type of support with the propensity to innovate of the firms of reference (**H_{2.1}**). This is also confirmed by the results of the point estimate of the associated parameter (0.345) and the advantage ratio associated with the variable (1.412). Thus, as an increase in public financial support from the European Union is witnessed within the framework of organizational innovations of the firm, its propensity to innovate also increases, with an advantage of 1.412 when compared with firms that do not benefit from the same type of support. This result is supported by the study by Porter and Stern (2001), particularly as these authors claimed that there is a macroeconomic level of performance of public policies that takes into account, in addition to the production of public goods and training, the focus on the evaluation of human resources and the creation of an environment that is conducive to innovation.

Precisely this level of performance meets the initiatives expected in terms of organizational innovation, according to the definition in the Oslo Manual (OECD, 2005) and the 2010 CIS itself (GPEARI-MCTES, 2010). Still, when it comes to public policy, the results indicate that the variables *public financial support from the central*

administration and *public financial support from the local/regional administration* do not show statistical significance in the organizational innovation model; hypotheses **H_{2,2}** and **H_{2,3}** are, therefore, not confirmed.

Finally, with regard to absorptive capacity, the results provide a response to each of the hypotheses that were formulated and are associated with this determinant – **H_{3,1}** and **H_{3,3}**. The results for each of the variables present a significant and positive effect on the propensity to innovate. That is to say that *employees with higher education* have a point estimate of the associated parameter (0.156) and a ratio of benefit associated with the variables (1.169) that provide the conclusion that this variable has a lead of 1.169 when compared with firms that do not have a substantial proportion of employees with higher education for organizational innovations. Furthermore, both *intramural R&D activities* and *extramural R&D activities* show an advantage of 1.044 and 1.102, respectively, when compared with firms that, as far as organizational innovation is concerned, do not invest in or develop such activities. The results obtained regarding absorptive capacity are indeed supported by authors such as Cohen and Levinthal (1990), who stated that one of the factors that influences and determines the propensity of firms to innovate is their incentive to invest in absorptive capacity, due to the expenses that R&D activities involve and the amount of knowledge that exists within the firm. This may be associated with the level of skilled human resources and de absorptive capacity like a composite variable involving human capital stock and the internal stock of knowledge (Teixeira and Fortuna, 2004). Grant (1996) also claimed that the ability to transform internal knowledge into new innovations is of great relevance to the innovative performance level. Garófoli (1995) added to this by highlighting how important it is for firms to guide their strategies at the local level, at which both the internal knowledge and the stock of that knowledge within the firm are concentrated. The author also stressed the relevance of public policies to stimulate innovation (Garófoli, 1995).

5. Conclusions

In consonance with the literature review, one may conclude that there has been an evolution in the concept of innovation as well as an increase in the interest among authors in analysing the effects of innovation on enterprises, organizations and even regions. This evolution in research implies not necessarily a break with the previous considerations and approaches of authors but rather an increase in the importance of the concept in the management of firms and countries. One may thus regard the evolution of this concept as underlying a perspective of dynamic interdependence. Hence, the conclusions of this research allow the proposition of some procedures that both firms and those responsible for implementing public policies may consider to improve innovative performance:

- To embrace the expediency of practical cooperation and integration into cooperation networks with external partners, from the perspective of sharing resources and synergies for the interdependence of supply, allowing a profit of scale and competitive advantages that are recognized in a globalized market;
- To consider the qualification of the firm's human resources as an element of the innovation process from the perspective of the involvement of manpower to increase the absorptive capacity and optimize the choice of the most proficient expertise for the innovative performance of the organizational type, as well as a great asset to the specialization of human resources;

- To implement policies of innovation encouragement that may drive production to external geographic markets by developing innovative initiatives with a differentiating potential able to establish goods and services produced in Portugal from an internationalization perspective;
- To develop inclusion practices concerning knowledge sharing that may allow the involvement of small businesses in innovation processes.

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